STATE OF IDAHO AUGMENTED ANADROMOUS

FISH HEALTH MONITORING

Annua I Report FY 1987

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Project No. 87-117
Contract No. DE-Al79-87BP65903

May 1988

ABSTRACT

The anadromous fish health monitoring program began in full operation in January 1988 after the hiring of the lead pathologist. This short operating period limits the amount of information available at the time of this writing. Pre-release sampling of smolts revealed the presence of several sub-clinical pathogens. Organosomatic analysis results demonstrated no major abnormalities in the examined stocks. The results of the 1988 steelhead broodstock sampling are still pending.

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INTRODUCTION

Columbia river basin anadromous fish populations have suffered a significant decline during the last century, in part from the impact of hydroelectric development. The Pacific Northwest Electric Power Planning and Conservation Act of 1980 created a basin-wide fish and wildlife program to mitigate the effects of hydroelectric power. Fish mitigation programs have centered on smolt production, providing safe passage, and harvest management.

The health and quality of hatchery produced smolts are major factors in overall survival, and one area which can be controlled by man. This study will provide Bonneville Power Administration with a fish health database from Idaho which when combined with similarlv formatrd data from other contractors will provide a consistant basin-wide picture of fish health. The ability to document health problems and production impediments should have a significant influence on BPA's goal of increasing the smolt-to-adult survival rate by at least 20 percent.

Bonneville Power Administration funding has enabled the Idaho Department of Fish and Game (IDFG) to institute a monitoring program for health and water parameters at its anadromous facilities to the level set forth by this contract.

Description of Study Area

Seven hatcheries listed in Table 1 are included in the monitoring contract. These facilities produce chinook and steelhead smolts (except Oxbow Hatchery, which is an adult holding and egg incubation facility) for their release into the Salmon and Snake River drainages. An anadromous hatchery (not included in the current contract) is being planned for the Clearwater river near the U.S. Fish & Wildlife Service Dworshak hatchery. All laboratory work was conducted at the Eagle Fish Health Laboratory, Eagle Idaho.

TABLE 1

Hatchery	Location	Water Source	Stock *
Rapid River	Riggins, ID	Rapid River	Spring Chinook (Hell's Canyon & Rapid R. mixed)
McCall	McCall, ID	Payette Lake	Summer Chinook (S.Frk Salmon R.)
Sawtooth	Stanley, ID	Salmon R./Well	Spring Chinook (E. Frk Salmon R. /Salmon River)
Pahsimeroi	Ellis, ID	Pahsimeroi R.	Summer Chinook (Pahsimeroi R./ S. Frk Salmon R.)
Niagara Springs	Wendell, ID	Spring	Steelhead (A) (Pahsimeroi R./ Hell's Canyon)
Magic Valley	Filer, ID	Spring	Steelhead (A) (Salmon River/ Pahsimcroi R.)
Oxbow	Oxbow, OR	Snake River	Steelhead (A) (Hell's Canyon)

As defined by Idaho Dept. of Fish and Game

Methods and Materials

The criteria for sampling and laboratory assays is outlined in Table 2.1 of the contract (Appendix A). The March 2, 1988 quarterly meeting resulted in a recommended modification of the minimum requirements stated in Table 2.1 of the contract. A finalized revision was not available at the time of this writing. Analysis for *Myxobolus cerebralis* was by the AFS Blue book pepsin/trypsin technique, with microscopic examination of wet mounts at 400X magnification. At the pathologists' discretion, there was no lot examination for proliferative kidney disease.

Monthly monitoring and sampling activities began in January 1988 after the hiring and subsequent program orientation of the lead pathologist on December 2, 1987. The short length of time the study has been in operation will limit the amount of information available in this report. A list of hatchery and stock abbreviations is described in Table 2.

Adults

Returning steelhead adults at Oxbow, Pahsimeroi and Sawtooth hatcheries were sampled for the presence of Infectious hematopoietic necrosis virus (IHNV), Infectious pancreatic necrosis virus (IPNV), Erythrocytic inclusion body syndrome (EIBS), *Renibacterium salmoninarum* (BKD), *Myxobolus cerebralis*, and *Ceratomyxa Shasta* during March and April 1988. Sampling procedures and laboratory assay methods were conducted as stated in the AFS Blue book (Amos, 1985). Ovarian fluid pellet smears (in addition to kidney imprints) were examined by fluorescent antibody technique for the presence of *Renibacterium salmoninarum* cells. The use of ovarian fluid pellets was one modification of Table 2.1 of the contract which was agreed upon by the steering committee at the March 2, 1988 quarterly meeting.

Juveniles

Monthly monitoring visits began in January 1988 (Appendix B). General examinations noted the gross external and internal morphology, coloration, and condition of the sampled fish. Microscopic examination of skin scrapings, gut smears, and excised gill filaments were also conducted to detect pathogens and morphological abnormalities. The disease status of moribund fish was determined by the appropriate method (gram stain, histology, bacterial and viral culture, etc.) at the discretion of the pathologist. Several diagnostic visits occurred during the study period in response to acute mortality situations. During 1987, anadromous stocks were surveyed for the presence of *Myxobolus cerebralis* by the pepsin/trypsin method (Amos 1985).

Pre-release examinations were carried out on all chinook and steelhead stocks. In December 1987, Ron Goede gave a three day workshop to IDFG personnel on his organosomatic evaluation method and use of his data manipulation program AUSUM. A monthly check of the following water parameters is being instituted as equipment and supplies are received: temperature, dissolved oxygen, % saturation, ammonia, pH and water hardness. A dBase III plus template for fish health records, graciously supplied by Jim Warren of the U.S. Fish and Wildlife Service, is currently being modifed for data management.

RESULTS

Objective 1.0 Complete Start-up Phase

Task 1.1 Acquire Competent Staff

On September 21, 1987, the fish health technician position was filled by Ms. Sharon Wavra. Task 1.1 was completed on December 2, 1987 when the fishery pathologist position was filled by J. Scott Foott.

Our team includes:

A. Kent Hauck, Fishery Pathologist Supervisor & Project Leader
J. Scott Foott, Fishery Pathologist & Lead Pathologist
Sharon Wavra, Fish Health Laboratory Technician
Sharon Landin, Fish Health Laboratory Technician
Bobbie Matthews, Laboratory Secretary

Task 1.2 Acquire all necessary equipment and supplies

Appendix C. lists major property items acquired during the first of the contract and a summary of expenditures.

Objective 2.0 Serve on the Project Technical Steering Commit

Task 2.1

Kent Hauck attended quarterly meetings in June and October 1987 Bozeman and Olympia respectively. Both Kent Hauck and Scott Foott attended the March 2, 1988 meeting at ODFW office in Clackamas, Oregon. Modifications to the methods in Task 2.1 were developed and will be incorporated in the contract.

Task 2.2

IDFG will develop for BPA approval a technology transfer and communcation plan. Tentative items within the plan will include laboratory method demonstration and training sessions for hatchery supervisors, project communiques for newspapers, presentations to Power Planning Council members, and contribution to a PNFHPC fish disease bulletin.

Task 2.3

A list of facility impediments and correction measures under consideration is reported in appendix D. A detailed cost sheet will be developed for submission in the year 2 annual report.

Objective 3.0 Conduct Augmented Fish Health Monitoring

Task 3.1

Organosomatic assessment system was developed by Goede (1987). The system is designed to assess the relative health and quality of a fish population. A Lotus 123 template program named AUSUM was developed by Goede and Houghton (1987) to facilitate data summation and reporting. Organosomatic assessment was carried during the pre-release sampling at the required index hatcheries. Reduced sample size assessments were also carried out on other anadromous stocks. The results are listed in Tables 2 - 5 . Below are the necropsy catagories in the organosomatic assessment system.

NECROPSY CLASSIFICATION

Length (L): Total Length in millimeters
Weight (W): Weight in grams

Condition factor (Ktl):

$$Ktl = \frac{W \times 10^5}{L^3}$$

Eyes: Normal (N), Exopthalmia (E1, E2), Hemorrhagic (H1, H2),Blind (B1, B2), Missing (M1, M2), Other (OT)

Gills: Normal (N), Frayed (F), Clubbed (C), Marginate (M),Pale (P), Other (OT)

Pseudobranchs: Normal (N), Swollen (S), Swollen & Lithic (S&L), Inflamed (I), Other (OT)

Thymus: No Hemorrhage (O), Mild Hemorrhage (1), Severe Hemmorhage (2)

Mesentery fat: Internal body fat expressed with regard to amount present

0 - None
1 - Little, where less than 50% of each cecum is covered
2 - 50% of each cecum is covered
3 - More than 50% of each cecum is covered
4 - Ceca are completely covered by large amount of fat

Spleen:	Black (B), Red (R), Granular (G), Modular (NO) Enlarged (E), Other (OT)
Hind Gut:	No inflammation (O), Mild inflammation (l), Severe inflammation (2)
Kidney:	Normal (N), Swollen (S), Mottled (M), Granular (G), Urolithiasis (U), Other (OT)
Liver:	A - Red B - Light red c - "Fatty" Liver; "coffee cream"color D - Nodules in liver E - Focal discoloration F - General discoloration OT -Other
Bile:	0 - Yellow or straw color; bladder empty or partially full 1 - Yellow or straw color; bladder full, distended 2 - Light green to "grass" green 3 - Dark green to dark blue/green
Blood:	Hematocrit - Volume of red blood cells (erythrocytcs) expressed as percent of total blood volume. Centrifuged 5 min at 10,000 rpm. Leucocrit - Volume of white blood cells (leucocytes) expressed as percent of total blood volume. Plasma Protein - Amount of protein in plasma, expressed as gram percent (grams per 100 ml). Determined with hand-held protometer.

TABLE 2

List of hatcheries and stocks on which a pre-release organosomatic analysis was conducted in 1988.

HATCHERY	STOCK (abbreviation)	SPECIES (abbreviation)
Pahsimeroi	Pahsimeroi R.(PSM)	Summer Chinook (SU)
	S. Fork Salmon R.(SF)	Summer Chinook (SU)
Sawtooth	Salmon R.(SWT)	Spring Chinook (SC)
	E. Fork Salmon R.(EF)	Spring Chinook (SC)
	Rapid R.(RR)	Spring Chinook (SC)
Rapid River	Rapid R.(RR)	Spring Chinook (SC)
	Hells Canyon (HC)	Spring Chinook (SC)
McCall	S. Fork Salmon R.(SF)	Summer Chinook (SU)
Magic Valley	Salmon R. (SWT)	Steelhead-A (SH)
	Pahsimeroi (PSM)	Steclhead-A (SH)
Niagara Springs	Pahsimcroi (PSM)	Steelhead-A (SH)

TABLE 3

Pre-Release Organosomatic Analysis
Average Length (mm), Weight (g), K-Factor

Hatchery	Stock-Species	Sample No.	Mean Length (SD)		Mean Weight (SD)		Mean K-Factor	
Pahsimeroi	PSM-SU	20	144.9	(12.2)	23.9	(7.8)	0.780	(0.09)
	SF-SU	20	139.7	(13.4)	27.1	(8.3)	0.990	(0.11)
Sawtooth+'	SWT-SC	60	124.2	(8.9)	16.8	(3.9)	0.880	(0.09)
	EF-SC	60	135.2	(19.3)	21.9	(11.5)	0.890	(0.06)
	RR-SC	60	127.3	(18.0)	18.6	(9.7)	0.900	(0.12)
Rapid River*	RR/HC-SC mix	60	135.0	(7.8)	21.9	(3.4)	0.890	(0.12)
McCall*	SF-su	60	140.1	(10.7)	23.9	(6.1)	0.870	(0.22)
Magic Valley	SWT-SH	16	206.6	(16.6)	90.9	(19.6)	1.030	**(0.10)**
	PSM-SH	20	195.3	(33.5)	82.4	(27.8)	1.110	(0.09)
Niagara Springs	PSM-SH	20	222.3	(21.2)	113.7	(29.0)	1.030	(0.09)

* Index hatchery as specified in task 3.1

TABLE 4

Pre-Release Organosomatic Analysis
Mean Hematocrit (%), Leucocrit (%), and Plasma Protein (g/dl)

Hatchery	Stock-Species	Sample #	Hct (SD)	Lct (SD)	Pl. Pro.(SD)
Pahsimeroi	PSM-SU	20	37.5 (3.4)	0.4 (0.4)	7.7 (1.0)
	SF-SU	20	42.5 (2.4)	0.3 (0.3)	7.3 (1.1)
Sawtooth ‡	SWT-SC	60	39.6 (4.1)	0.8 (0.3)	5.8 (1.2)
	EF-SC	60	41.6 (3.9)	1.3 (0.3)	4.3 (0.9)
	RR-SC	60	42.0 (5.9)	0.6 (0.4)	5.7 (1.8)
Rapid River*	RR/HC-SC mix	60	38.0 (5.5)	N T	6.4 (1.1)
McCall*	SF-SC	60	45.4 (6.5)	0.7 (0.4)	7.0 (1.3)
Magic Valley	SWT-SH	16	47.3 (3.9)	0.9 (0.4)	4.6 (0.7)
	PSM-SH	20	46.2 (4.5)	0.7 (0.2)	4.8 (1.5)
Niagara Spgs	PSM-SH	20	38.1 (3.2)	1.2 (0.4)	4.7 (1.0)

‡ Index Hatchery

Leukocrit qualitatively measured in units of 0.5mm.

NT - Not Taken

TABLE 5

Pre-Release Organosomatic Analysis
Qualitative Organ Assessments Considered Significant

Hatchery	Stock-SPP	Thymus 0	Thymus 1	Mesentery Fat 2	Mesentery Fat 3	Mesentery Fat 4	Notes
		Percent per Category					
Pahsimeroi	PSM-SU	100	0	0	90	10	Unlisted organs rated as normal
	SF-SU	85	15	30	60	10	
Sawtooth	SWT-SC	100	0	8	87	5	Unlisted organs listed as normal
	EF-SC	100	0	17	83	0	
	RR-SC	100	0	5	95	0	
Rapid R.	RR/HC-SC mix	100	0	63	38	0	Due to BKD: 2% mottled kidney 4% Exopthalmia 2% Nodular spleen Also: 5% swollen Pseudobranch 2% mottled gill
McCall	SF-SU	100	0	0	100	0	2% Exopthalmia
Magic Valley	SWT-SH	30	70	0	100	0	Unlisted organs rated as normal
	PSM-SH	85	15	0	85	15	
Niagara Springs	PSM-SH	80	20	0	100	0	Unlisted organs rated as normal

Task 3.2 Test for specific pathogens

Pathogen data for monthly visits, Myxobolus cerebralis prevalence and pre-release samples are listed in Tables 6, 7, 8 respectively. Results for the steelhead broodfish sampling are still pending.

Objective 4.0 Conduct studies of hatchery water supplies

Task 4.1

The submitted water sampling plan is listed in Appendix E. IDFH is awaiting BPA solicitation of a laboratory contractor.

Task 4.3

Monthly flow index and density index data is currently being compiled from the study facilities and will be reported in year 2.

Objective 5.0 Record, analyze and report Fish Health Monitoring and related data.

Task 5.3

A hatchery visit data form submitted to BPA for approval on January 13, 1988,is shown in Appendix F.

Task 5.2

We are in the process of adopting a USFWS dBase III+ fish health reporting template for our use.

Objective 6.0 Estimate projects benefits

Task 6.1 - Task 6.1.5

Due to the limited time in which the project has been operating, this information will be compiled and reported in Year 2. Rearing unit baffle trials were conducted at McCall, Rapid River and Sawtooth hatcheries in 1987 (Hoerscn & Westers, 1986). The respective hatchery managers reported that the baf f les were ef fectivc in flushing solid wastes to the foot of the unit and in evenly partioning the fish throughout the rearing unit. Mortal icy rates were similar to control rcnring units. The overall opinion of the baffles was very favorable.

Table 6

Infectious agents encountered during monthly hatchery visits

HATCHERY	AGENT
Pahsimeroi	*Epistylus sp.*
Sawtooth	*Epistylus sp.*, *Hcxamita sp.*, *Renibacterium salmoninarum*
Rapid River	*Epistylus sp.*, *R. salmoninarum*, *Pseudomonas* Saprolegniasis
McCall	*Trichophyra sp.*
Magic Valley	*Flexibactercolumnar-is*
Niagara Springs	*Gyrodactylus sp*, *Epistylus sp* ,IHNV, Chronic myxobacteriosis
Oxbow	*Lernaea sp.*

TABLE 7

Prevalence of <u>Myxobolus cerebralis</u> Infection in Anadromous Stocks

by Pepsin/Trypsin Digestion Method - Work to Date

Hatchery	Stock/Spp	Sample Date	Prevalence Fish #	Prevalence Pools	Histological Confirmation
Pahsimeroi	PSM/SC	B-19-87	10	1/1	
	SF/SU		13	2/2	
Sawtooth	RR/SC	8-19-87	57	4/9	
	SWT/SC		88	6/19	+
	EF/SC	7-24-87	154	12/30	
McCall	SF/SU	8-10-87	60	0/6	
Rapid River	RR&HC/SC	8-10-87	120	0/12	–
Magic Valley	PSM/SH	8-19-87	110	0/6	
	SWT/SH		70	0/12	–
Niagara Sp.	HC/SH	8-18/9-9-87	98	0/9	–
	PSM/SH		330	l/33 Presumptive	-

TABLE 8

Pre-Release Smolt Pathogen Prevalence Results

Hatcherv	STOCK	No./lbs.	5 Fish Pools IPNV	5 Fish Pools IHNV	EIBS	BKD
Pahsimeroi	PAH-SU	15.1	0/12	0/12	0/60	4/60
	SF-SU	16.2	0/12	0/12	0/60	5/60
Sawtooth	RR-SC	25.8	0/12	0/12	0/60	4/60
	SWT-SC	22.0	0/12	0/12	0/60	2/60
	EF-SC	20.1	0/12	0/12	0/60	0/60
McCall	SF-SU	18.7	0/12	0/12	0/60	9/60
Rapid R.	RR/HC-SC	19.3	0/12	0/12	0/60	12/60
Magic V.	PAH-SH	6.1	0/12	0/12	0/60	2/60 +
	SWT-SH	6.5	0/12	0/12	0/60	5/60 +
Niagara S.	HC-SH	5.0	0/12	7/12	0/60	0/60
	PAH-SH	4.2	0/12	9/12	0/60	0/60

* Due to low number of Hell's Canyon fry, the stocks were mixed with Rapid R. fish.

n/c Not completed.

\+ These resuls arc presumptive as a retrospective quality control check of the conjugae used showed fluorescent contaminates.

SUMMARY

The organosomatic analysis results showed no obvious departures from normal values . It will be of great interest if a correlation between body fat amounts and smolt survival can be documented in the next five years. The validity of including the "semi-quantitative" leucocrit measurement in any data analysis is in question. Leucocrit should be measured using a microscope equipped with a calibrated ocular scale (Wedemeyer et al. 1983). This method is labor intensive and therefore would not be applicable for field use. Leucocrit values obtained using the current organosomatic method should therefore be treated as crude estimates only. Thymic inflammation in several stocks is another point of interest which will require research to correlate this pathology with the fish's general health. Two chronic disease problems which occurred at Rapid River Hatchery (Saprolegniasis) and Niagara Springs Hatchery (Myxobacteriosis) will be monitored on a monthly basis in 1988. At Niagara Springs, a prophylactic treatment of 1 ppm nifurpirinol (10% active) will be administered to an experimental group of fry 24 hours prior to their transfer from the nursery tanks to the production raceway. These fish will be compared to a non-treated control group for mortality and fin condition for 3 months. At Rapid River, a monthly survey for EIBS and taxonomic identification of the infective Saprolegnia species will be conducted. The significant disease situations which occurred in the first year of the contract include the diagnosis of Myxobolus cerebralis in the Salmon river drainage and the IHNV outbreak among steelhead smolts at Niagara Springs hatchery.

Acknowledgements:

Thanks to the Bonneville Power Administration for the funding of this project.The author wishes to thank the hatchery crews and the following hatchery managers for their assistance: Bob Moore, Tom Rodgers, Tom Levendofske, Tom Frew, Bud Ainsworth, Jerry Mowery, and Doug Burton.

Laboratory work included in this report was conducted by the Sharon Wavra, Sharon Landon and Patrick Chapman.

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Table 2.1.

Analyses	Life Stage	Samples per lot	Fish lots	Frequency of Sampling	Methods/Remarks
I. PHYSIOLOGICAL ANALYSES:					
A. Physiological Quality:					
1. Organosomatic Analyses	Smolt	60	all	Pre-lib	Do only BPA approved species at "index" locations; use method of Goede. 1/
II. WATER PARAMETERS					
1. Flow Index	all	1	all	monthly	Use Piper et al. 2/
2. Loading Density	all	1	all	monthly	Use Piper et all. 2/
3. Sample Water Supply	N/A	N/A	N/A	Twice/year	Water supply only, at seasonal low flow. Use Standard Methods" (14th edition). 3/
III MONTHY VISITS	Juvenile	10	All	MONTHLY	Examine morbid fish, if less than 10 moribund fish found, then utilize asymptomatic fish using appropriate techniques as described in section IV.

1/ Goede, R. Organosomatic examination of trout, Utah Division of Wildlife Resources, Logan, Utah. (unpublished).

2/ Piper, R. C., I. B. McElwain, L. E. Orme, J. P. McCarren, L. G. Fowler, and 3. R. Leonard. 1982. Fish Hatchery management. 517 pages. U.S. Fish and Wildlife Service, Washington, D.C.

3/ Standard Methods for the Examination of Water and Waste Water. 14th edition. American Public Health Association, American Water Works Association, and Water Pollution Control federation, Washington, D.C.

4/ Amos, K., 1985. Procedures for the detection and Identification of Certain Fish Pathoges. American Fisheries Society. Fish Health Section, Bethesda, MD. 119 pages.

Analyses	Life Stage	Samples per lot	Fish lots	Frequency of Sampling	Methods/Remarks
IV. INFECTIOUS DISEASES:					
A. Parasitic Diseases:					
1. Whirling Disease	Juvenile	60	Most susceptible species only unless typical signs are present.		Use AFS (1985). 4
2. Ceratomyxosis — (*C. Shasta*)	Juvenile Adult	10 up to 20	all	monthly year	Sample morts in surface water supplies only, June through October. Consider as a factor in pre-spawning mortality. Use AFS (1985). 4/
3. Proliferative Kidney disease (PKX)	Juvenile Smolt Moribund	10	all	see Remarks	Sample morts in surface water supplies, if kidney is swollen. Confirmation must be done via histopathology. 5/
B. Viral Diseases:					
1. Infectious Hematopoietic Necrosis (IHN)	Juvenile	10	all	See Remarks	°Only if clinical signs exist, number is minimum. Tissue Culture per AFS (1985). 4/.

4/ Amos, K., 1985. Procedures for the detection and Identification of Certain Fish Pathoges. American Fisheries Society. Fish Health Section, Bethesda, MD. 119 pages.

5/ Smith, C. E., J. K. Morrison, H. W. Ramsey, and H. W. Ferguson. 1984. .Oroliferative Kidney disease; First Reported Outbreak in North America. J. Fish. Disease 7:207-206

Table 2.1. (continued)

	Analyses	Life Stage	Samples per lot	Fish lots	Frequency of Sampling	Methods/Remarks
2.	Infectious Pancreatic Necrosis (IPN)	Smolts	60	all	pre-lib	ºSample 60 smolts if IPN has been found; Tissue culture Use AFS (1985). 4/
		Adults	60	all	at spawning	
3.	Erythrocytic Necrosis (EIBS)	Juveniles	Sample moribund if anemic, CWD BKD, or fungus is present.			Blood smear Use AFS(1985)4/
		Smolts	60	all	Pre-lib	
		Adults	60	all	spawning	
C.	**Bacterial Diseases:**					
1.	Bacterial kidney disease (R. salmoninarum) (BKD)	Juveniles	60	all	Mid-term	Sample individual fish. Use fluorescent antibody technique (FAT) described in AFS (1985). 4/
		Smolts	60	all	Pre-lib	
		Adults	60	all	At Spawning	
2.	Coldwater disease (C. psychrophila) (CWD)	Fry-Smolts	VARIABLE	all	When typical CWD mortality is occurring.	Confirm via Gram Stain
3.	Furunculosis (A. salmonicida) (FUR)	Fry-Smolts	Up to 10	all	When FUR clinical signs visible during monthly visits	Culture on TSA media per AFS (1985). 4/
		Adults	up to 20 morts.	Pre-spawning mortality		

4/ Amos, K., 1985. Procedures for the detection and Identification of Certain Fish Pathoges American Fisheries Society. Fish Health Section, Bethesda, MD. 119 pages.

Table 2.1. (continued)

	Analyses	Life Stage	Samples per lot	Fish lots	Frequency of Sampling	Methods/Remarks
4.	Enteric red mouth (Y. *ruckeri*) (ERM)	Fry-smolt	up to 10	all	When ERM clinical signs visible during monthly visit.	Culture on TSA per AFS (1985). 4/
		Adults	up to 20 morts	Pre-spawn mortality		

4/ Amos, K., 1985. Procedures for the detection and Identification of Certain Fish Pathoges. American Fisheries Society. Fish Health Section, Bethesda, MD. 119 pages.

APPENDIX B

Summary of Hatchery Visits

Hatchery	January	February	March	April
Pahsimeroi	1	1	2	1
Sawtooth	1	1	1	1
Rapid River	1	1	1	1
McCall	1	2	1	1
Magic Valley *	1	1	1	0
Niagara Springs*	1	1	2	0
Oxbow **	1	0	0	1

* Smolt release starting 4-4-88, no fry until June

** Adult holding facility - spawning conducted in April

APPENDIX C

List of nonexpendable equipment greater than $1000 and summary of expenditures as of March 31, 1988.

Tensionometer / DO Meter	$ 4,475
Hematology Stainer	2,295
Analytical Balance + Case	1,170
Plankton Centrifuge	956
Water Bath	1,087
Personnel Costs	18,291
Operating Costs	16,656
Capital Outlay	8,827**

** Departmental expendure data incomplete for latest purchases.

APPENDIX D

TASK 2.3 FACILITY IMPEDIMENTS

Below is a list of facility impediments corrections under consideration which have an impact on fish health at the six anadromous hatcheries under the contract (Magic Valley hatchery is excluded as it went on-line this year and will need to be evaluated in year 2). A cost/benefit evaluation will be given in the year 2 report.

RAPID RIVER HATCHERY

The river water supply subjects the hatchery to high suspended sediment loads during the spring runoff. This water quality problem results in gill abrasion, poor feeding response, and accumulation of sediment in the rearing containers.

IMPEDIMENT CORRECTION UNDER CONSIDERATION	BENEFITS
1) Install concrete sides in pond 3 (evaluate results from pond 2)	Improve flow pattern increase depth uniformity
2) Install baffles in nursery raceways	Flush wastes, improve fish distribution, provide shade, and reduce injuries from sweeping
3) Settling basin for hatchery water supply	Reduce spring runoff sediment problem
4) Change pond 1 inflow to eliminate prior flow through empty raceway	Reduce Gill Disease source
5) Disinfection system (UV/ozone) for hatchery water supply	Eliminate disease impact of upstream resident fish

McCALL HATCHERY

1) Water filtration system for incubation stacks	Reduce egg loss due to sediment and algae smothering
2) Install baffles in nursery vats	Flush wastes, improve fish distribution, provide shade, and reduce injuries from sweeping

3) Disinfection system (UV/ozone) for hatchery water supply	Eliminate disease impact of resident fish in water supply

SAWTOOTH HATCHERY

1) Install baffles in vats and raceways	Flush wastes, improve fish distribution, provide shade, and reduce injuries from sweeping
2) Sediment pond tailrace modification to shunt effluent to river rather than adult holding ponds	Eliminate disease transmission from hatchery and reduce organic load in adult ponds
3) Disinfection system (UV/ozone) for hatchery water supply	Eliminate whirling disease and river-borne pathogen problems

PAHSIMEROI HATCHERY

1) Install baffles in nursery raceways	Flush wastes, improve fish distribution, provide shade, and reduce injuries from sweeping
2) Aeration equipment for ponds	Maintain proper D.O. levels (DO data to be collected this summer)
3) Disinfection system (UV/ozone) for pond water supply	Eliminate whirling disease and river-borne pathogen problems

OXBOW HATCHERY

1) Well water supply for incubators	Provide proper temperature, filtered water for eggs

NIAGARA SPRINGS HATCHERY

The primary impediment involves the early rearing operation.

1) Increase nursery rearing space	Reduce tank densities
2) Install air pump and tank aeration equipment	Increase DO levels especially at the bottom of tanks. Provide emergency back-up (at present densities a 30 min flow cut-off results in a 8-10 ppm D.O. drop)
3) Disinfection system (UV/ozone) for hatchery water supply	Eliminate disease impact of resident fish in spring

APPENDIX E

WATER SAMPLING PROPOSAL (TASK 4.1)
December 1987

FACILITIES	WATER SOURCE	POSSIBLE CONTAMINANT SOURCE
1) Magic Valley	ground	agricultural
2) McCall	surface	forestry, mining
3) Niagara Springs	ground	agricultural
4) Oxbow	surface	Snake River-numerous input
5) Pahsimeroi	ground/surface	forestry/Rangelands
6) Rapid River	surface	forestry, mining
7 Sawtooth	surface	forestry

GENERAL PARAMETERS
Methodologies and sensitivity levels are listed on page E3.

PARAMETER	SAMPLE FREQUENCY	ASSAY BY
1) Total Ammonia	monthly	pathologist
2) Dissolved Oxygen	monthly	pathologist/hatchery
3) pH	monthly	pathologist
4) Temperature	daily	hatchery
5) Hardness	bi-annually	laboratory
6) Hydrogen Sulphide	bi-annually	laboratory
7) Carbon Dioxide	bi-annually	laboratory
8) Nitrite	bi-annually	laboratory
9) BOD-5	bi-annually	laboratory
10) Alkalinity	bi-annually	laboratory

TRACE METALS AND CONTAMINANTS:

All parameters to be tested at least initially at each facility and bi-annually at those facilities that demonstrate harmful levels (see page E6).

Cadmium	Manganese	Fluoride
Chromium	Mercury	Arsenic
Copper	Selenium	Cyanides
Iron	lron	Chlorine (Chloramines)
Lead	Aluminum	Phenols

PESTICIDES:

This list was compiled from information supplied by sources in the state health and welfare department, highway department, county agricultural extension, and federal forest service. Those pesticides (both leachable and absorptivej with the highest application rates in Idaho are listed. It is assumed that this list is incomplete and will be updated as required. Site specific pesticides are indicated by:

F/H - Forestry/Highway input   A - Agricultural input

HERBTCIDES:

COMMON NAME	SITE	TRADE NAME	96H-LC50 TROUT(REF2)
alachor	A	lasso	1.4 mg/L
picloram	F/H	tordon	4.0 mg/L
dicamba	F/H	banvcl	28.0 mg/L
2,4-D	A, F/H		2.0 mg/L
2,4,5-T	A		17.2 mg/L
Glyphosate	A, F/H	roundup	130 mg/L
EPTC	A	eptam	17 mg/L
atrazine	A	aatrex	
simazine	A	princep	>lOO mg/L
treflan	A	trifluralin	41 ug/L

INSECTICIDES:

aldicarb	A	tcmik	0.56 mg/L
carbaryl	A	scvin	1950 ug/L
carbofuran	A	furadan	380 ug/L
diazinon	A	alfa-tox	90 ug/L
disulfoton	A	bay 19639	1850 ug/L
fenvalevate	A		
malathion	A		27 ug/L

FUNGICIDES:

COMMON NAME	SITE	TRADE NAME
carboxin	A	vitavex
chlothyalonil	A	bravo
PCNB	A	terraclor

Other compound classes of interest:
1) Petroleum hydrocarbons
2) Polychlorinated biphenyls
3) Organophosphates
4) Surfactents (MBAS)

REFERENCES CITED:

1) Methods for chemical analysis of water and wastes. Revised March 1983. EPA-600/4-79-020.

2) Johnson, W.W. and M.T. Finley. 1980. Handbook of acute toxicity of chemicals to fish and aquatic invertebrates. USFWS Resource Publ. 137.

3) Standard methods for the examination of water and wastewater, 16th edition 1985. APHA/AWWA/WPCF.

4) Summary of water quality criteria for salmonid hatcheries. 1979. Sigma Resource Consultants, Ltd.

5) Wedermeyer, G.A. and W.T. Yasutake. 1977. Clinical methods for the assessment of the effects of environmental stress on fish health. USFWS Tech. Paper 89.

Methodologies and sensitivity levels from Standard methods for the examination of water and wastewater. 16th ed. unless otherwise stated.

PARAMETER	METHODOLOGY
Ammonia (NH3)	Samples taken at both top and bottom of raceway. Field testing by ammonia electrode method with sensitivity of .017 ppm (Corning Ammonia Electrocle 476139). If laboratory testing is required, the phenate method is preferred and the samples need to be preserved with H_2SO_4 at 4 C.
Dissolved Oxygen	Samples taken at both top and bottom of raceway. Field testing by portable D.O. meter with an accuracy of + 1.5% full scale and measurement to two decimal places (Cole-Parmer 5513-55).
PH	Samples taken at both top and bottom of raceway. Field testing by Fish model 640 pH meter with accuracy of $\pm$ 0.01 pH.
Hardness	Sample taken at intake and preserved by addition of HNO_3 to reach pH2 (hold at 4 C). Calculated from calcium and magnesium measurements. 2.497 (Ca) + 4.118(Mg) = mg equivalents $CaCO_3$/L. Alternate method is the magnesium EDTA exchange-calorimetric method (EPA600, method 130.1).
Hydrogen sulphide	Samples taken at both top and bottom of raceway and preserved by addition of zinc acetate. Assay by methylene blue - colorimetric method with sensitivity of 0.1 ppm.
Carbon dioxide	Sample(s) taken at effluent and intake (ground water sources only). Store at 4C for maximum of 24 hrs. Assay by phcnolphthalein method. Alternately, calculate from pH, temperature, and biocarbonate alkalinity data using nomograph.
Nitrate	Sample taken at intake (effluent if high silt condition) and refrigerated at 4 C for maximum of 24 hrs. If assay cannot be done before 24 hrs., preserve with sulfuric acid. Assay by diazotizing with sulfanilamide and coupling with N-(naphthyl)-ethylcncdiaminc dihydrochloride (colorimetric method). Sensitivity level to 0.05 ppm .

BOD5	Sample at both top and bottom of raceway. Chill to 4 C for a maximum storage time of 24 h. Assay using EPA600 manual 5 day method (405.1).
Alkalinity	Sample at intake only and hold at 4 C. Assay by titrimetric method (EPA600, method 310.1).

All trace metals and arsenic can be assayed by atomic absorption spectroscopy from the same nitric acid preserved sample. Mercury should be assayed by the cold vapor method. Sample to be taken at intake onlv.

Fluoride	Sample at intake only (groundwater sources). Assay by ion selective electrode (potentiometric) method. Sensitivity 0.1 - 1000 mg/L.
Cyanide	Sample at intake only and preserve by adding NaOH (pH12) l Assay total cyanide by colorimetric method in which cyanide is converted to CNCl by reaction with chloramine T and color is formed by pyridine-pyrazolone. Sensitive to 0.02 ppm.
Chlorine	Sample at intake only. Assay by DPD-calorimetric (chloramines) method with a sensitivity to 0.2ppm.
Phenols	Sample at intake only and preserve by adding copper sulfate and sulfuric acid (4 C). Assay within 24h by chloroform extraction/calorimetric (MBTH or 4-AAP) method with a sensitivity to 2 - 5 ug/L.
Petroleum Hydrocarbons	Sample 1 liter at intake only (surface water) and preserve by adding HCL (pH5) and holding at 4 C. Assay by spectrophotometric method (EPAbOO-method 418-l) with a sensitivity to 1 ppm.
Polychlorinatcd Biphcnyls	Sample at intake only (surface water - domestic input).
Orthophosphates	Sample at intake only and preserved with H2S04 at 4 c. Assay by calorimetric/ascorbic acid method with sensitivity to 0.01 ppm.
Surfactent (MRAS) anionic types	Sample at intake only and assay using method 425.1 (EPA600).

Pesticides will be assayed by column chromatography methods. Many of the pesticides of interest can be grouped together in general class scans. The exact methods and sensitivities will be provided by the analytical water laboratory as this field is constantly changing. The pesticide list will be modified for site specific conditions (i.e., forestry vs. agricultural input).

Safe chemical levels for salmonid culture
(Ref. 4 unless otherwise stated).

PARAMETER	SAFE LIMIT	NOTES	REF NO.
Ammonia	<0.005 ppm		6
PH	6.5 - 8.5	Affects toxicity of other compounds.	
H2S	<2 ug/L		
co2	(25 ppm	Affects pH	
NO2	(100 ppb soft H20/200 ppb hard H20		6
Aluminum			
Cadmium	(0.4 ug/L		
Chromium	10.003 ppm	hexavalent ion most toxic	
Copper	<O.006 - 0.03 ppm	depending on water hardness	
Iron	<0.3 ppm	Fe(OH) 3 ppt. acts as irritant	
Manganese	<1 PPm		
Selenium			
Mercury	<0.2 ppb		
Zinc	<10 ug/L		
Arsenic	<1 PPm		
Cyanide	<5 ug/L		
PCB's	do.001 ug/L		
Phenol	<20 ppb	Chronic gill problem	

APPENDIX F

SITE: SPECIES/ STOCKS/ BROOD YR/ LIFE STAGE
DATE:
ACCESS#: LOCATIONS IN HATCHERY

EXAM TYPE:

No./LOT

TOTAL LOT WT.

AVE FISH WT/LOT

FOOD CON.(MONTH)

FOOD CON.(TO DATE)

DATE LAST HANDLED/TYPE

DIET TYPE/SIZE

INFLOW (gpm)

FLOW INDEX

DENSITY INDEX

MORT/EXAM DAY

MORT. EST.

PREVIOUS MONTH MORT.

MEDICATION/Amt.

WATER SOURCE(S) REUSE % / TYPE
POND VOL.(cf) CONTAINER TYPE/CONSTRUCTION

UNIT	TOP	BOTTOM	PH
BAR			HARDNESS
TEMP			
Pt			
%SAT			
P			
PO2			
Pt-p02			
NH3			

HISTO BACTE VIRAL WD FAT SMEARS OTHER
